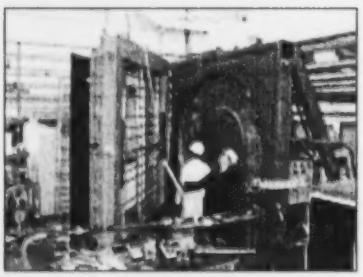
Volume 7 Number 2 June 2002

construction innovation

NRC · CNRC

MEWS Consortium methodology now available for use

North American building products manufacturers now have a powerful new tool at their disposal: a methodology to help them evaluate the ability of building components to manage moisture in any geographic location in North America. The methodology is the end-result of IRC's Consortium for Moisture Management for Exterior Wall Systems (MEWS), a four-year project that brought together researchers from IRC's Building Envelope and Structure Program, staff from its Codes and Evaluation Program, and 11 industry partners (see sidebar, p. 8).



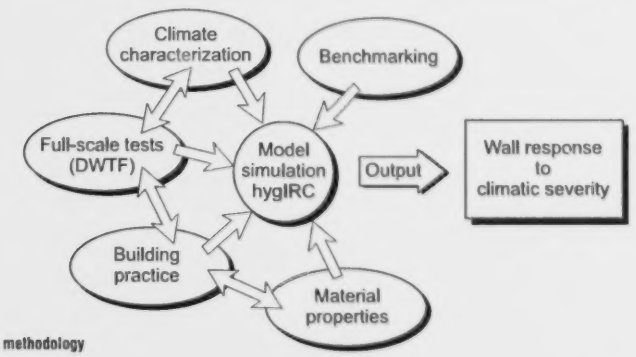
Researchers use IRC's Dynamic Wall Testing Facility (DWTF) to help characterize the performance of various wall assemblies.

Moisture management essential to building longevity

The climate in North America varies widely according to geographic region, and in some locations, according to season. Buildings must be able to withstand combinations of extreme heat and cold, wind, humidity and precipitation—and sometimes all four.

Of these, moisture is the most difficult to handle. Uncontrolled moisture accumulation in the building envelope reduces its structural integrity by mechanical, chemical and biological degradation. The damage that results can include rotting of wood studs and other wood-based products, efflorescence and spalling of masonry systems, and rusting of wall fasteners. It can provide a breeding ground for harmful organisms. And it can affect the efficiency of thermal insulation and the building's appearance.

Effective moisture control, therefore, is essential to achieving acceptable service life for the built environment. This control involves both minimizing moisture entry into the system and maximizing moisture exit from the system, so that no component stays "too wet" for "too long."



MEWS methodology

Methodology brings together a wide range of information

The MEWS methodology can help manufacturers design products with the best blend of durability, moisture resistance and drying time to handle given moisture conditions. Helping them avoid the "too wet for too long"

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Highlights

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2007-03607/

CCBFC makes decisions on the objectives of the national model codes

A multi-year process to analyze the content and determine the objectives of the National Building Code, the National Fire Code and the National Plumbing Code is now complete. In a ballot in April 2002, the Canadian Commission on Building and Fire Codes (CCBFC) agreed that the objectives of these codes should be as follows:

National Building Code	National Fire Code	National Plumbing Code
Safety Fire safety Structural safety Safety in use Resistance to unwanted entry Safety at construction and demolition sites	**Safety** Fire safety Safety in use	**Safety** Safety in use Fire safety Structural safety
Health Indoor conditions Sanitation Noise protection Vibration and deflection limitation Hazardous substances containment	**Health** Hazardous substances containment	**Health** Indoor conditions Sanitation Hazardous substances containment
Accessibility Barrier-free path of travel Barrier-free facilities		
Fire and structural protection of buildings Fire protection of the building Structural sufficiency of the building Protection of adjacent buildings from fire Protection of adjacent buildings from structural damage	**Fire protection of buildings and facilities** Fire protection of the building or facility Protection of adjacent buildings or facilities from fire	**Protection of the building or facility from water and sewage damage**

Note: The definition of each objective and sub-objective and more detailed content may be found at the CCBFC Web site at www.ccbfc.org.

The Commission is currently seeking the concurrence of the provinces and territories on these objectives. Some further minor changes may result.

Now that the Commission has confirmed the objectives, the work to prepare the prototype objective-based codes can be completed. The first step will be to convert the 1995 model building, fire and plumbing codes to an objective basis. This will involve the creation of third-level objectives (the table shows first- and second-level objectives); functional statements, which describe what is to be achieved; and links to acceptable solutions, which are essentially the provisions of the 1995 codes. At the end of this process, code users will be able to assess full-scale working models (prototypes) of the objective-based codes.

The working models will be submitted to the provinces and territories for review in 2002, with final versions expected to be complete by the fall of 2002. At that time, a coordinated national public consultation will take place, providing code users with an opportunity to comment on the working models.

Refinements based on the comments received will be made and the approved technical changes (see article, p. 3) incorporated into the new objective-based code documents, which are expected to be published in June 2004.

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1 800 672-7990
or if you would prefer to subscribe to the online version, simply go to http://www.nrc.ca/irc/newsletter/toc.html, type your e-mail address in the box, and hit "submit." It's that easy.

Public consultations on the prototype objective-based codes and a parallel but separate consultation on technical changes to the national model codes are expected to take place in the fall of 2002.

For more information about the prototype codes, proposed technical changes and the related public consultation processes, please visit www.ccbfc.org/ccbfc/home_E.shtml, or contact Mr. John Archer at (613) 993-5569, fax (613) 952-4040, or e-mail codes@nrc.ca.

Proposed technical changes for the new objective-based codes

Major technical changes to the national model code documents—the National Building Code (NBC), the National Fire Code (NFC) and the National Plumbing Code (NPC)—have been proposed by the various standing committees responsible for the three codes to update or remove outdated material and to add new provisions in several subject areas.

The Canadian Commission on Building and Fire Codes (CCBFC) and the provinces and territories will be undertaking a coordinated national public consultation on the proposed technical changes to the national model codes in the fall of 2002.

This issue of *Construction Innovation* will describe some of the more significant technical changes proposed for the NFC and the NPC. The next issue will feature proposed changes to the NBC, Parts 3 and 9.

Proposed changes to the NFC

Rapid technological advancements, coupled with regulatory, industry, and stakeholder concerns, have led to proposed editorial and technical changes to the next edition of the NFC. These include:

- **Revision of the leak detection and monitoring of underground and above-ground storage tank systems**

Comments received by NRC's Canadian Codes Centre from stakeholders indicated that the NFC provisions (Subsection 4.3.15., 4.3.16., and 4.4.6.) dealing with leakage detection of storage tanks and piping systems for flammable and combustible liquids were in need of revision to reflect current technologies and practices. With industry and regulatory input, proposed changes would establish:

- new minimum levels of system leakage testing required at the commissioning stage
- new minimum levels of continuous in-service monitoring
- the frequencies at which both testing and commissioning must occur.

Based on new information, certain practices that are currently permitted by the NFC will likely be eliminated. For review purposes, the proposed changes have been temporarily placed in a new Section 4.12, which can be found on the CCBFC Web site at www.ccbfc.org.

- **New values for the quantity of dangerous goods permitted to be stored or displayed in "big box stores"**

Concerns raised by regulators over the storage of dangerous goods (i.e., oxidizers, propane, and flammable and combustible liquids) in "big box stores" led to the creation of a task force to study the adequacy of current NFC provisions for the storage of such materials. As a result, several changes to Table 3.2.7.1. have been proposed that would limit quantities of specific products, thus decreasing the risk of fire in this type of occupancy.

Continued on page 9

Proposed changes to the NPC

There are currently three versions of venting requirements in use across Canada: the National Plumbing Code, the Ontario Building Code and the British Columbia Building Code. The three versions have common elements but they use different definitions and nomenclature for venting systems. In essence, all versions result in plumbing systems that work; however, trades people working in different areas of Canada have to follow the specific requirements of each jurisdiction to obtain regulatory approval. There is little question that the harmonization of these requirements in a single national code would make life much simpler for the trades.

With this goal in mind, the Standing Committee on Building and Plumbing Services and its Task Group on Harmonizing Venting Requirements Across Canada have developed a harmonized version of the venting requirements, which will be available for public comment in the fall of 2002.

Another significant change proposed by the committee concerns harmonization of the CSA Backflow Standard B64.10 and the NPC backflow requirements. At present, these documents have conflicting and overlapping requirements, giving rise to concerns about their application and relative priority in the field. The recommendations of the committee's Task Group on Harmonization of NPC and CSA B64.10–M94 have resulted in substantial proposed changes to these requirements in Subsection 6.2. of the NPC. In addition, Article 6.2.4., which deals with backflow from fire protection systems, has been updated to include new materials, systems and definitions for different classes of systems.

Other proposed technical changes deal with:

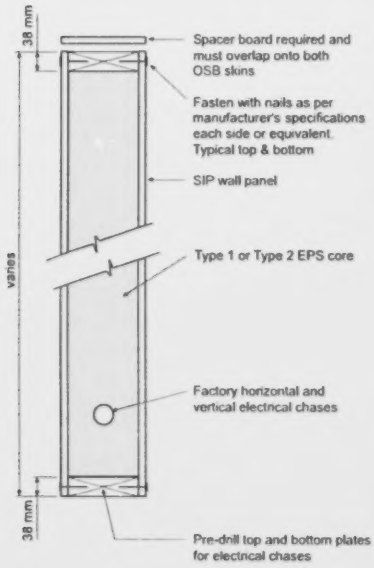
- Macerating toilets, which have been available for some time;
- Air admittance valves for limited applications, such as island sink venting;

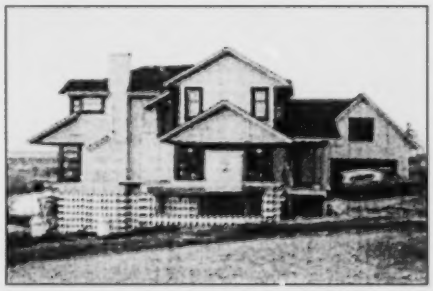
Continued on page 9

CCMC evaluates a single-rib structural insulated panel system

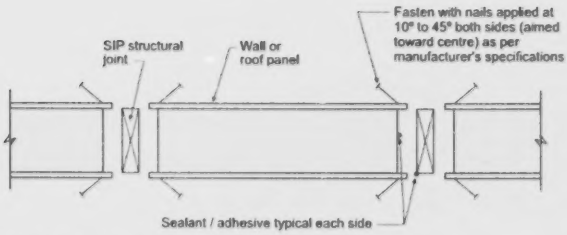
IRC's Canadian Construction Materials Centre (CCMC) has just evaluated a product that gives builders in Canada another option for walls and roofs: a single-rib structural insulated panel (SIP) system rather than the currently available multiple-rib structural systems (at conventional spacings of 400 mm or 600 mm). More and more, builders are considering the use of SIP systems because they combine the structural system, wall and roof sheathing, and insulation in a single step.

Developed by Plasti-Fab of Calgary, Alberta, the PlastiSpan SIP system brings the Canadian building market one step closer to offering pure SIP systems that use no ribs. The system consists of a 7/16" oriented strand board (OSB) bonded to both sides of an expanded polystyrene (EPS) insulation core. It incorporates single structural ribs at the panel edges, every 1200 mm, with a specific nailing schedule (see figure). The structural ribs are made of 2x4s for the wall panels and of either 2x10s or prefabricated wood I-joists for the roof panels.


38 mm
Spacer board required and must overlap onto both OSB skins
Fasten with nails as per manufacturer's specifications each side or equivalent. Typical top & bottom
SIP wall panel
varies
Type 1 or Type 2 EPS core
Factory horizontal and vertical electrical chases
38 mm
Pre-drill top and bottom plates for electrical chases



Stressed skin panels with structural ribs are used for both walls and roofs in these houses.


SIP structural joint
Wall or roof panel
Fasten with nails applied at 10° to 45° both sides (aimed toward centre) as per manufacturer's specifications
Sealant / adhesive typical each side

PlastiSpan SIP System wall panels

CCMC's evaluation confirms that the structural reliability of the PlastiSpan SIP system is equivalent to the structural design principles of CSA O86, the engineering design code for wood. The panels also meet the air leakage requirements described in the National Building Code (NBC), as well as the vapour diffusion control requirements when there is painted drywall on the warm side of the wall assembly and vinyl siding on the cold side.

In addition, CCMC's report looks at the use of the PlastiSpan SIP system without structural ribs in post and beam or timber frame construction (see photo). The report confirms that the wall tables and roof span charts produced with Plasti-Fab's reliability-based model are accurate and comply with the intent of the NBC. It also confirms the system's seismic performance relative to conventional wood-frame shear walls.

One of the limitations noted in the report concerns roof applications: if the top OSB layer becomes wet during construction, it must dry before installing the low-permeance roof cladding to reduce the risk of trapped moisture. Thus, in SIP construction, there must be extra attention to detail to ensure that drying can occur. In conventional roof construction, trapped moisture is less of an issue because the sheathing can dry toward the attic space. Of course, it is always considered standard good practice for all wood-based products to prevent excessive wetting in the first place.

CCMC Evaluation Report No. 13016-R is available on the Web at: http://www.nrc.ca/ccmc and upon request from CCMC. For further information, contact Mr. Bruno Di Lenardo, CCMC, at (613) 993-7769, fax (613) 952-0268, or e-mail bruno.di_lenardo@nrc.ca.

Mutual recognition arrangements: impact on building regulators and CCMC

The Canadian Construction Materials Centre (CCMC) relies heavily on laboratory test results to demonstrate product compliance to the requirements of its technical guides and evaluation directives. Recognition of these laboratories, covered by CCMC's "Guidelines on Laboratory Recognition and Product Testing," emphasizes the priority given to organizations accredited by the Standards Council of Canada (SCC).

The SCC regularly signs mutual recognition agreements with its counterpart organizations throughout the world. And although CCMC acknowledges the agreement between the SCC and its U.S. counterparts (see box below), similar agreements with other countries require consideration on a case-by-case basis.

Mutual recognition arrangements between the Standards Council of Canada and its counterparts worldwide facilitate the foreign acceptance of results from Canadian testing organizations. But what obligations do these arrangements impose on Canada's building regulatory system?

The relatively new Mutual Recognition Arrangement (MRA) that the SCC has signed with 15 accreditation organizations in countries around the Pacific Rim, under the Asia Pacific Laboratory Accreditation Cooperation (APLAC), serves as a case in point.

At a recent meeting hosted by the SCC, this arrangement was introduced and input from regulators sought regarding the implementation of the MRA. The regulators expressed concern that they would be obliged to accept, as equivalent, the results of test methods other than those specified in the Canadian codes. This is in fact not the case. The arrangement encourages the regulator to accept the test results from the foreign laboratory, but only if the laboratory has performed the test according to Canadian specifications. There is no obligation resulting from the arrangement. The regulator always has the final responsibility for deciding on the acceptability of test results. But how can the building regulator be assured that the foreign laboratory fully understands the intent and subtleties of a particular Canadian standard?

It is widely recognized that not all details of a test methodology are precisely defined and that variations can occur, even in Canadian laboratories. As part of the review leading up to the signing of an MRA, proficiency testing to compare the results of common tests by several accredited laboratories must be conducted.

In the case of the APLAC arrangement, proficiency testing carried out for construction-related test methods was negligible. While the system is evolving, there has not yet been sufficient time and experience to gain confidence in this system. (Canadian regulators' confidence in U.S. laboratories is based on consistency of results over a significant period of time.) However, the new agreement presents an excellent opportunity for future mutual recognition in the construction sector.

Specific questions can be directed to Mr. John Berndt at (613) 993-5353, fax (613) 952-0268, or e-mail john.berndt@nrc.ca.

CCMC recognition of U.S. laboratories

When CCMC's guidelines on laboratory recognition and product testing were first prepared, the SCC had a mutual recognition agreement with the National Voluntary Laboratory Accreditation Program (NVLAP) in the U.S. This meant that the SCC had confidence that a NVLAP-accredited lab would meet the same level of performance as it would if accredited by the SCC itself. In turn, CCMC recognized laboratories accredited by NVLAP. Later, a similar agreement was confirmed between the SCC and the American Association for Laboratory Accreditation (A2LA) and, most recently, the ICBO (International Conference of Building Officials) Evaluation Service, Inc. (ICBO ES).

Experience has provided consistent test results from laboratories in the United States; no doubt due, in part, to the fact that many of CCMC's required tests can be found in ASTM standards. CCMC automatically considers a laboratory accredited by one of these three organizations as meeting its recognition guidelines.

Newsbrief

WFTAO renews its mission and objectives

The World Federation of Technical Assessment Organisations (WFTAO) met in October 2001 to enhance its role in transferring assessed products across national boundaries.

At the meeting, the federation confirmed its objective to facilitate trade through the acceptance of technical assessments by its members. It will continue to promote the role of technical assessments as the principle means for demonstrating the fitness for purpose of a construction product that is innovative or for which no standard exists.

The federation is an informal network of 25 organizations from 21 countries that share a common interest in the technical assessment of innovative and non-standardized construction products. From its inception in 1996, the WFTAO has developed into a forum for exchange on the issues surrounding technical assessment and facilitation of trade in construction products.

For more information on the World Federation of Technical Assessment Organisations, visit http://www.wftao.com or contact Mr. John Berndt, General Secretary, WFTAO, at (613) 993-5353, fax (613) 952-0268, or e-mail john.berndt@nrc.ca.

Results of fire-resistance testing on wall assemblies will provide housing industry with important new information

The completion of an IRC collaborative research project to develop fire-resistance ratings for various types of wall assemblies will assist builders and regulators in choosing suitable wall assemblies, particularly for multi-family dwellings.

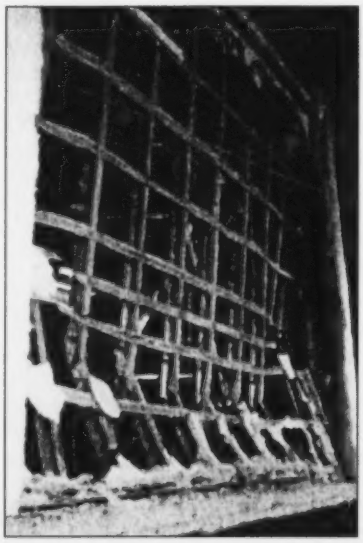
As part of the project, the load-bearing steel-stud assemblies that are often used as party walls in townhouses and multi-unit buildings were evaluated (see *Construction Innovation*, Volume 1, Number 4). The results of a related project may also affect sound-transmission ratings for the same assemblies (see sidebar, p. 7).

Full-scale tests on whole wall systems

IRC's Fire Risk Management Program, working with nine industry partners (see sidebar) conducted 14 full-scale standard tests to look at the effect of various parameters on the fire resistance of load-bearing steel-stud wall assemblies. Test parameters included:

- the spacing of steel studs;
- the number of stud rows (i.e., single- versus double-stud walls);
- the number of gypsum board layers (i.e., one versus two layers of protection);
- the use of cross-bracing;
- the replacement of one layer of gypsum board with an oriented strand board (OSB) shear membrane;
- the use of resilient metal channels to support the gypsum board; and
- the type of insulation used in the wall cavity.

Rather than concentrating on individual materials, each test assessed a whole wall system that was the same size as those commonly used in North American buildings. This approach allowed a complete picture of fire performance in various scenarios.



Load-bearing steel-stud wall assembly after fire test

The researchers exposed each assembly to fire in a propane-fired vertical furnace until it failed in one of three ways: structural failure; exceeding a specified temperature; flame or gas penetration. In all cases, the wall assemblies failed structurally. The unexposed surface temperature at this time was below the temperature criteria for failure.

Stud spacing and type of insulation most important factors

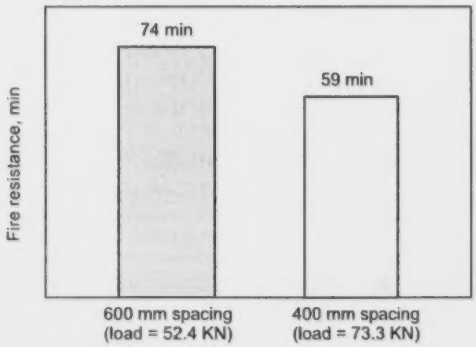
Two of the factors that most affected the performance of load-bearing steel-stud wall assemblies were the stud spacing and the type of insulation.

Industry partners

Canadian Home Builders Association
Canadian Sheet Steel Building Institute
Canadian Steel Construction Council
Canadian Wood Council
Cellulose Insulation Manufacturers Association of Canada
Forintek Canada Corporation
Gypsum Manufacturers of Canada
Owens-Corning Canada
Roxul Inc.

Stud spacing

For stud spacing, the results indicate that steel-stud wall systems with stud spacing of 610 mm provided higher fire resistance than those systems with stud spacing of 406 mm. This difference in fire-resistance performance is attributable to the fact that the wall assembly with wider spacing has fewer studs than the wall assembly with closer spacing and therefore carries a smaller load. In accordance with the test protocol, the load is based on the number of studs—fewer studs mean a smaller overall load. In the course



Effect of stud spacing on the fire resistance of load-bearing steel-stud wall assemblies

of the fire tests for both assemblies, the load shifts to the end studs, which are less exposed to fire than the inner studs. But since the end studs must carry a greater load for the wall assembly with closer spacing, this assembly fails more quickly than the assembly with wider spacing.

Type of insulation

As for insulation, the results indicate that uninsulated wall assemblies provide a higher fire resistance than those assemblies with insulation. While adding insulation to the wall cavity improves the acoustics of the assembly, it reduces the fire resistance. There are two reasons for this reduction in fire resistance:

1) The insulation keeps the gypsum board facing the fire hot, causing it to crack and fail more quickly than in an empty cavity. Once it has failed, the insulation and studs are exposed to the heat of the fire.
2) The insulation allows the heat to build up and become trapped in the cavity, thus hastening the structural failure of the studs.

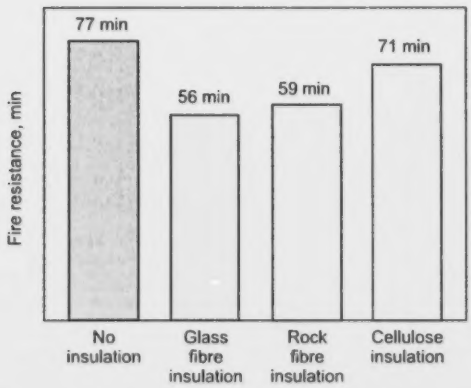
The results also showed that there is considerable variation in the effects of different types of insulation on fire resistance.

Specific questions about the fire-resistance performance of these wall assemblies can be directed to Dr. Venkatesh Kodur at (613) 993-9729, fax (613) 954-0483, or e-mail venkatesh.kodur@nrc.ca.

Industry impact

Although the projects showed that uninsulated assemblies performed better in terms of fire resistance while insulated assemblies were superior acoustically, they also identified a wide variety of constructions that provide both satisfactory fire resistance and noise control in terms of meeting National Building Code (NBC) requirements. As well, by studying sound and fire together, some constructions that don't meet the intent of the code were also identified.

A group of industry partners are drafting a proposed addition to the Appendix to Part 9 of the NBC, which could result in many more entries for steel-stud wall assemblies in the table of fire-resistance ratings (FRR) and sound transmission class (STC) ratings for walls. These fire and sound ratings make it possible for designers and builders to assess an assembly's compliance with code requirements.



Effect of insulation type on the fire resistance of load-bearing steel-stud (single-row) wall assemblies

Sound performance results will also lead to greater choice for housing industry

To satisfy the need for both sound and fire ratings for party walls, the Acoustics Group, part of IRC's Indoor Environment Program, worked on a related project to study the sound transmission characteristics of steel-stud wall assemblies.

Using wall assemblies similar to those tested for fire resistance, the acoustics researchers found that the method of framing had some effect on sound transmission. Each wall assembly tested had one row of load-bearing studs and used horizontal resilient metal channels to support the gypsum board covering on one side.

One focus of the project was the effect of shear bracing, such as might be used in earthquake-prone areas. The researchers found that steel framing elements, such as blocking or cross-bracing straps, had a negligible effect on sound transmission. Adding an oriented strand board layer between the studs and the attached gypsum board, however, improved the sound transmission class (STC) as a result of the increased surface weight. (The higher the STC, the greater the noise reduction.)

The single most important parameter to sound transmission was the weight of the gypsum board surface layers. Typically, the STC improved by about 5 when the weight of the gypsum board on either side of the wall was doubled. The researchers demonstrated this improvement by both changing the number of gypsum board layers on the assembly and changing their weight.

Other ways to improve the STC include: filling the inner-stud cavities with fibrous insulation, allowing for greater spacing between the resilient channels and using studs made of thinner steel. In fact, the STC improved by 8 to 10 when stud cavities were completely filled with insulation, although the type of insulation had only a slight influence.

Specific questions about the project can be directed to Dr. Trevor Nightingale at (613) 993-0102, fax (613) 954-1495, or e-mail trevor.nightingale@nrc.ca.

MEWS Consortium methodology now available for use

Continued from cover page

problem could result in big savings on property maintenance and operation.

The methodology integrates information from a variety of sources, which include:

- a review of field practices;
- extensive measurements of the hygrothermal properties of building materials;
- definitions of environmental loads to reflect climatic conditions;
- the results of experiments on wind-driven rain penetration; and
- a detailed parametric analysis using IRC's benchmarked hygrothermal model called hygIRC.

First findings available this fall

Currently, the methodology has been used to identify and develop the critical design considerations for five types of wood-frame construction: stucco cladding, exterior insulation and finish systems, masonry cladding, wood siding, and vinyl siding. The final summary report is being reviewed by the partners and will be available to the public in the fall of 2002.

Several other task-group reports will also be available at this time. Topics include: construction practices, hygrothermal properties of various building materials in North America, procedures to analyze and select weather data for design purposes, a test protocol for assessing moisture-related damage to wood and wood-based building materials, laboratory investigation of air leakage and wind-driven rain penetration in walls, and parametric analyses using the hygIRC model.

Building product manufacturers interested in accessing the MEWS methodology can do so through IRC. In addition, it is possible that the methodology will be adapted in support of both the ongoing National Building Code development process and the Canadian Construction Materials Centre's (CCMC) product evaluation process. For more information, visit the MEWS Consortium Web site at http://www.nrc.ca/irc/bes/mews/index.html.

MEWS Consortium industry partners

Louisiana-Pacific Corporation
Marriott International Inc.
Fortifiber Corporation
EIFS Industry Members Association
E.I. DuPont de Nemours & Company
Canadian Wood Council
Canadian Fibreboard Manufacturers Association
Masonry Canada
Canadian Plastics Industry Association
Canada Mortgage and Housing Corporation
Forintek Canada Corporation

Upcoming events continued from page 12

2003

JANUARY

29-30

ASTM Symposium on Durability of Building and Construction Sealants and Adhesives (2003-DBCSA). Fort Lauderdale, FL. Contact: Andreas Wolf at 32 64 888.177; Fax: 32 64 888.950; E-mail: Andreas.Wolf@dowcorning.com

FEBRUARY

3-4

Revaluing Construction—the International Agenda. Manchester, UK. www.revaluing-construction.com

MAY

6-10

International Conference on Tall Buildings. Strategies for Performance in the Aftermath of the World Trade Center & The 2nd CIB Global Leaders Summit on Tall Buildings. Kuala Lumpur, Malaysia. http://www.cibklutm.com

Newsbrief

Concrete researchers to study potential of lithium salts in preventing concrete deterioration

IRC is seeking partners to investigate the potential of lithium salts to help prevent spalling and cracking in large concrete structures, such as dams, bridges, airfields and stadiums, as a result of alkali silica reaction.

Alkali silica reaction (ASR) occurs when the active silica in the aggregate reacts with alkalis from either the cement or the environment. Aggregates such as gneiss can cause expansion within structures, reducing durability, and adversely affecting strength and appearance, to name just a few of the possible consequences.

In recent years there have been reports in the technical literature on the ability of lithium salts to arrest ASR, which have fueled a debate on the feasibility of using these compounds in place of those currently used.

The conventional remedy for ASR is the use of pulverized fly ash, a by-product from coal-fired power stations. The main disadvantages of using this material are that it is dirty, hard to handle and has variable results. However, justifying the replacement of fly ash with lithium salts is difficult, in spite of the latter's ease of application: Lithium salts are relatively expensive, and the chemical mechanism that halts the alkali reaction is not fully understood.

Since there have been few real-life applications of lithium salt technology, its long-term performance cannot be predicted. However, further research on this technology should provide some answers about its suitability as an alternative to fly ash.

The IRC project will focus on identifying the arresting mechanism of lithium salts in the belief that this is key to their future use, for both new concrete and existing structures.

If you are interested in participating in this project, please contact Dr. Lyndon Mitchell at (613) 998-0064, fax (613) 954-5984, or e-mail lyndon.mitchell@nrc.ca.

Proposed technical changes to the NFC

Continued from page 3

- **New NFPA reference to address the inspection and testing of standpipe and hose systems**

Recent changes to NFPA installation standards have resulted in the integration of inspection, testing, and maintenance procedures for standpipe and hose systems into a single standard, NFPA 25 "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," which also contains some new information. At present, this standard is not referenced in the NFC, but to address the concerns of regulators and ensure adequate testing and inspection of standpipe and hose systems, a reference in Part 6 of the NFC is proposed.

- **Revamping of ammonium nitrate storage requirements**

Current NFC requirements in Subsection 3.2.9. "Indoor Storage of Ammonium Nitrate" do not distinguish between storage requirements for fertilizer-grade and blasting-grade ammonium nitrate. A complete revision of Subsection 3.2.9. is proposed to address current industry storage and handling practices and to harmonize with existing NFPA standards.

Proposed technical changes to the NPC

Continued from page 3

- Dishwasher connections for the discharge line;
- Island sink venting details (in the form of diagrams);
- Open-port backwater valves, which prevent backflow automatically;
- ABS pipes with a cellular core, which are lighter weight than solid wall pipes;
- Drainage in elevator pits by means of drain connections;
- Shut-off valves on all fixtures in houses;
- Water hammer arresters and their conformance to an ASSE standard (home-made devices no longer considered acceptable);
- Cleanouts in health care facilities dealing with bodily fluids that could be hazardous to cleaners;
- Deletion of discontinued products, such as polybutylene and aluminum piping material;
- Temperature and pressure-relieving valves for domestic hot water tanks.

The standing committee has reviewed the NPC for the purpose of identifying and deleting outdated requirements, and has updated or clarified existing requirements to ensure enforceability. All of the proposed changes are subject to a joint CCBFC/provincial and territorial review in early 2003, at which time they may be modified or withdrawn as a result of comments received.

The changes listed above are just some of the proposed changes to the NFC and the NPC. Code users are strongly encouraged to view the complete list of changes on the CCBFC Web site www.ccbfc.org during the public consultation in the fall of 2002, at which time they can submit comments.

To receive notification of the consultation, code users should contact the Canadian Codes Centre at (613) 993-9960 or e-mail: codes@nrc.ca.

Construction Technology Updates 1-48

are now available *free* on the IRC Web site at http://www.nrc.ca/irc/catalogue/ctu.html

Please note that print versions of these Updates are still available, at new reduced prices:

- Single Updates: $5 (minimum order $15)
- Any selection of 6 Updates: $25
- Any selection of 12 Updates (2001 collection excepted): $35
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New table for fire and sound resistance of floors, ceilings and roofs

The Canadian Commission on Building and Fire Codes announces the publication of an expanded Table A-9.10.3.1.B., "Fire and Sound Resistance of Floors, Ceilings and Roofs." The new table covers a larger array of assemblies rated for use in buildings covered by Part 9 of the National Building Code (NBC). The table can be found in the Fourth Revisions and Errata to the NBC, which are available free of charge from IRC's Client Services or can be downloaded from IRC's Web site at http://www.nrc.ca/irc/publications/downloadform.html.

Study helps quantify economic benefits of cathodic protection in water mains

An IRC-led consortium project to study the effects of retrofit cathodic protection on water mains indicates that this approach can have a significant impact on life-cycle costs and extend their economic life.

Cathodic protection (CP) is recognized as a viable approach to reducing breaks in metallic water mains; however, its effectiveness varies according to the specific conditions under which it is applied. Retrofit CP refers to the practice of systematically protecting existing pipes with galvanic cathodic protection.

In 1999, IRC initiated a research project supported by a consortium that includes Canadian water utilities and a CP component manufacturer (see sidebar) to develop methods to quantify the performance of existing CP programs and tools to aid utilities in optimizing the implementation and scheduling of CP programs.

Corrosion and cathodic protection

Corrosion is an electrochemical process that requires the presence of both oxygen and moisture. In this process, which can be compared to a battery, an electric current passes through a conducting solution, such as water, between two parts of the same metal or between different metals. The current flows from an anodic area (positive electrode), which corrodes, to a cathodic area (negative electrode), which does not corrode. Corrosion can occur uniformly over the whole surface or locally.

Cathodic protection in effect reverses the electrochemical process by introducing a metal that is higher on the galvanic scale (the anode) and hence more likely to corrode. The protecting (sacrificial) anode becomes the metal that is depleted by corrosion rather than the pipe.

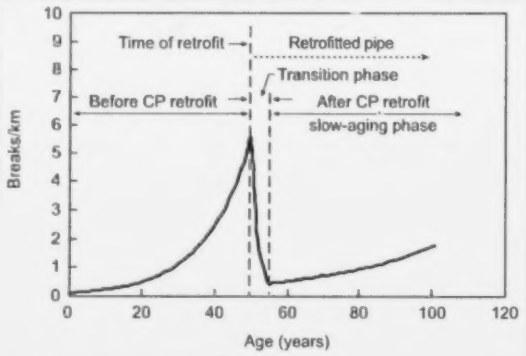

Figure 1. Breakage-rate pattern before and after retrofit CP

Consortium partners

This research was supported by the water utilities of Halifax, NS; Gatineau, QC; Ottawa, ON; Peterborough, ON; Markham, ON; Toronto, ON; Niagara Falls, ON; Hamilton-Wentworth, ON; Windsor, ON; Saskatoon, SK; Calgary, AB; Edmonton (EPCOR), AB; and by CorrPro Inc.

Major project findings

The analysis of pipe-break records from several water utilities revealed a typical breakage-rate pattern with three different phases:

Phase 1: Before CP retrofit. During this phase, the breakage rate grows nearly exponentially.

Phase 2: After CP retrofit—transition phase. Following retrofit there is a transition period during which the breakage rate drops. This drop occurs because the pipe is likely to have some deteriorated parts prior to retrofit, meaning that breakage is imminent. CP retrofit delays these breaks—hence the drop in breakage rate (transition phase)—but cannot prevent them altogether.

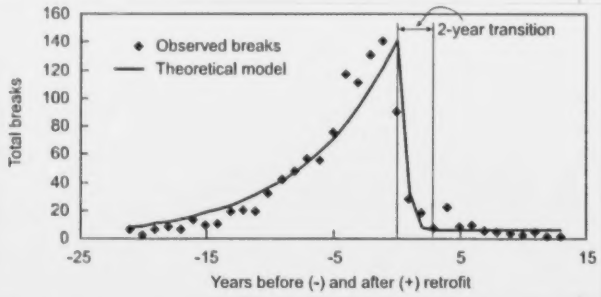

Figure 2. Breakage-rate pattern for pipes in an Ontario municipality

Phase 3: Post retrofit. Once the newly protected pipe is "purged" of these imminent breaks, it continues to age, but usually at a lower rate than prior to retrofit. In order to maintain this low aging rate, the CP anodes need to be continually monitored and replaced upon depletion.

Figure 2 demonstrates how a group of pipes in an Ontario municipality fits this breakage-rate pattern, although there are insufficient data to clearly indicate the breakage rate after retrofitting.

The curves in Figure 3 illustrate the total life-cycle costs of a water main from time of installation to time of replacement with retrofit CP implemented at different points in the cycle. As the pipe ages, the rate of repair typically increases, and at the same time, as replacement is

U.S. information integration movement: What's in it for Canada's construction industry?

An industry-led collaborative not-for-profit research consortium in the United States called FIATECH (Fully Integrated and Automated Technology) envisions a time when all aspects of the construction process flow seamlessly from concept and design to dismantling of capital facilities. The group believes that commercializing and implementing the latest available technologies will bring about this integration and result in savings of both time and money throughout a facility's life cycle. FIATECH membership includes over 45 companies from across the industrial spectrum, including Bentley Systems, Primavera Systems, (US) Army Corps of Engineers, Bechtel and Chevron Texaco.

What's happening with FIATECH in the U.S. also needs to happen in Canada, says IRC's Chris Norris. IRC joined FIATECH about a year ago and has been taking a "watch and brief" approach, acting as the Canadian construction industry's eyes and ears at the meetings and disseminating the information gathered there.

"The U.S. construction industry is very fragmented, with most players doing their own thing," says Norris. "Until now, there has been no common forum in the U.S. to lead IT and automation developments in the industry. The situation is similar in Canada. Many companies and organizations in this country are trying to develop integrated processes in-house, but industry-wide efforts to make this happen are not coordinated."

Over the long term, FIATECH intends to reduce costs and schedules for capital projects by 30 percent by reducing design changes and reworks, and by detecting and rapidly correcting differences between design intent and construction. The tools that FIATECH will use to achieve these goals include integrated software applications, 4-D visualization, advanced communications, field sensing and tracking, modularization, pre-construction (such as off-site assembly and prefabrication) and automation in the field and during construction.

To begin a similar shift in Canada, Canadian industry has three broad options: wait and adopt whatever solutions the FIATECH initiative generates; organize a parallel activity to FIATECH and produce a 'made in Canada' solution; or have companies join FIATECH collectively or individually.

FIATECH is in the midst of documenting industry needs and priorities, developing a vision for the industry, and drafting a roadmap to help realize this vision. In fact, the first draft of this roadmap is now available for purchase though FIATECH and public consultations on it are imminent.

"The publishing of this draft roadmap provides the perfect opportunity for Canadian firms to become involved in FIATECH if they want to," says Norris. "The organization is looking to build momentum by inviting participation. If they decide to join individually, Canadian companies could have their needs reflected in the next generation of the roadmap."

If, on the other hand, Canadian companies decide to group together to address the issues raised by FIATECH, an opportunity to discuss their options may soon present itself. The newly formed National Steering Committee for Innovation in Construction (NSCIC) is aiming to hold an industry-wide forum on innovation issues as a follow up to a previous symposium (see *Construction Innovation*, Volume 6 Number 3), which could provide the occasion to start the dialogue.

For more information on FIATECH, visit the Web site at http://www.fiatech.org. Specific questions about NSCIC can be directed to Mr. Chris Norris at (613) 993-0125, fax (613) 941-0822, or e-mail chris.norris@nrc.ca.

delayed, the present value of its cost decreases. The total cost is represented by a convex curve, whose minimum (denoted by T*) depicts the optimal time for replacement, which can be considered the end of the economic life of this pipe.

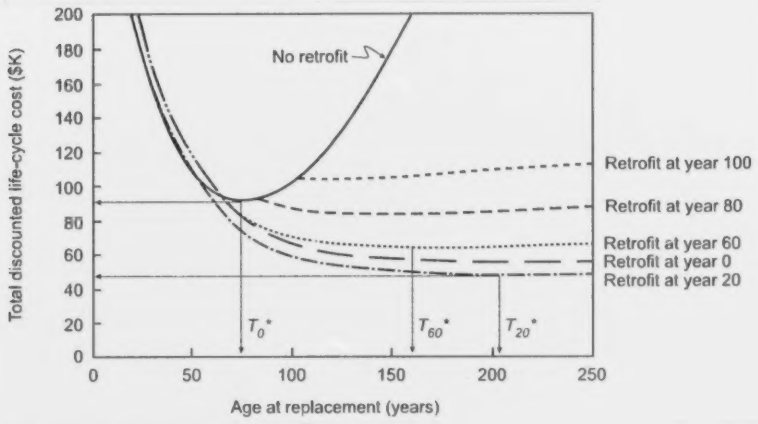

Figure 3. Total life-cycle costs of a retrofitted pipe

For the water main shown in Figure 3, the best strategy is to retrofit at 20 years, which extends its economic life from 70 to more than 200 years and reduces its total life-cycle costs from about $80K (without CP) to about $50K. The figure also shows that very late implementation of retrofit CP (e.g., at 100 years) may reduce the total life costs of the pipe but may not extend its economic life.

As part of the project, IRC is developing a software tool that will enable municipalities to model the reaction to cathodic protection and subsequent aging of their systems, thus helping them to customize their CP strategies.

Specific questions can be directed to Dr. Yehuda Kleiner at (613) 993-3805, fax (613) 954-5984, or e-mail yehuda.kleiner@nrc.ca.

Building Science Insight

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Seminar Series – 2002
Sound Isolation and Fire Containment Details That Work

Organized by: Institute for Research in Construction
National Research Council Canada

The walls and floors separating dwellings in apartment buildings and other multi-family buildings must serve many functions other than structural. This seminar provides an overview of factors affecting both the fire resistance and sound transmission ratings of wall assemblies and floor assemblies. To select assemblies, designers need ready access to collections of test ratings, but for successful installations they must appreciate how overall fire resistance and sound isolation may be compromised by the details in a complete building. The presentations and supporting materials also deal with these practical issues.

The seminar will begin with presentations explaining the fire resistance and sound transmission for typical wall and floor assemblies.

Airborne sound transmission through walls and floors. The weight and stiffness of the layers of materials, the separation between layers, the thickness and type of sound-absorbing material, and joist or stud type and spacing determine how much sound passes through the structure. These factors are discussed so designers can get maximum benefit from the design selected. Examples are given for typical assemblies.

Noise due to footsteps or other impacts. Simple floor coverings and resiliently supported floating floors reduce impact noise but the effectiveness depends on the base floor. A covering that reduces impact sound transmission through a concrete floor may have negligible benefit on a joist floor. Optimum designs for different types of floors will be discussed.

Fire resistance of wall and floor assemblies. Fire resistance depends on the materials and how they are assembled, but the physics of fire depends on different properties of the materials and their assembly from those that control sound. Recent studies on the effect of changing specific components of framed wall and floor assemblies are summarized, along with some design recommendations.

To put these concepts into practice, designers need ready access to ratings of assembly performance, but also must appreciate how overall performance for fire resistance and sound isolation may be compromised by the details in a complete building. Some changes improve both sound transmission ratings and fire resistance, while others improve one but worsen the other. The rest of the presentations deal with these practical issues.

Ratings for wall and floor systems. Ratings are needed both by designers and by those approving designs. An overview of the expanded tables in Part 9 of the National Building Code will be presented, together with a demonstration of simple software tools to facilitate access to relevant ratings.

Fire-stops at concrete wall-floor junctions. Fire-stops must control fire spread without significantly increasing sound transmission. This talk examines generic solutions, using the case where walls with two rows of studs meet a floor assembly as the main example to illustrate general principles.

Flanking sound transmission. When wall and floor assemblies are combined in a building, sound energy can be transmitted around the nominal separation by leaks or by structural vibration. This flanking transmission may limit the sound isolation achieved in practice. Design and retrofit approaches are discussed for many common cases, with emphasis on wood-frame construction.

- ***Ottawa***
  September 25, 2002
- ***Toronto***
  October 1, 2002
- ***St. John's***
  October 7, 2002
- ***Charlottetown***
  October 8, 2002
- ***Halifax***
  October 11, 2002
- ***Yellowknife***
  October 21, 2002
- ***Edmonton***
  October 23, 2002
- ***Winnipeg***
  October 25, 2002
- ***Vancouver***
  November 4, 2002
- ***Calgary***
  November 6, 2002
- ***Saskatoon***
  November 8, 2002
- ***Toronto***
  November 13, 2002
- ***Aylmer (French)***
  November 20, 2002
- ***Montreal (English)***
  November 25, 2002
- ***Montreal (French)***
  November 26, 2002
- ***Sainte-Foy (French)***
  November 28, 2002

See Web site for details.

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Canada

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Performance of Thermal Insulation on the Exterior of Basement Walls
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CI

New Revisions and Errata to Building Codes Now Available

The Fourth Revisions and Errata to the *National Building Code of Canada 1995* (NBC) and to the *Quebec Construction Code – Chapter I, Building, and National Building Code of Canada 1995 (amended)* (QCC), as well as the Second Revisions and Errata to the *National Fire Code of Canada 1995* (NFC) are now available to all users of these codes. The revisions and errata documents feature Code revisions approved by the Canadian Commission on Building and Fire Codes, and provide corrections and information updates to facilitate the use of the codes. NBC and QCC revisions and errata are identified by an ***r4*** and ***e4*** respectively; NFC revisions and errata are identified by an ***r2*** and ***e2*** respectively.

The pertinent revisions and errata packages are being mailed to binder and soft cover users who purchased their codes directly from NRC or who returned the reply cards at the front of their books to NRC. CD-ROM users have been sent a notification of the availability of the revisions and errata in electronic format on IRC's Web site at **http://codes.nrc.ca/codes/home_E.shtml** (click on **CD-ROM** and then **CD-ROM Revisions and Errata**). Once the patch is installed, the annotations will appear at the appropriate locations within the Code document.

If you own any of these codes and do not receive your copy of the applicable revisions and errata, you can either download and print the PDF files from **http://www.nrc.ca/irc/publications/downloadform.html** or contact IRC's Publication Sales Department:

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We've "renovated" the National Housing Code!

The revised edition of the ***National Housing Code of Canada 1998 and Illustrated Guide*** is now available in two practical, portable formats: an 8.5 x 11 soft-cover book and a Special Edition CD-ROM with improved search and print capabilities.

This comprehensive two-in-one reference document will help you build with ease.The Code portion contains all the National Building Code requirements from Parts 1, 2, 3 and 9 that are related to the construction of single detached, semi-detached and row houses. These requirements have been re-ordered so as to reflect the sequence in which housing is actually designed and built. The Guide portion clarifies the Code requirements with additional information, examples of industry building practices, and over 300 colour illustrations. It deals with a wide spectrum of building issues, such as foundations, sound transmission, windows, and garages.

This revised edition contains updated information, improved figures and three revisions. Current owners of the National Housing Code can download the pages with revisions from IRC's Web site at ***http://www.nrc.ca/irc/catalogue/housing.html***.

The soft-cover version of the National Housing Code is now available for $94, and the CD-ROM version for $179. An invaluable resource for home builders, designers, building officials, inspectors and contractors…and you! To order, contact IRC's Publication Sales department:

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Upcoming events

JULY

31-Aug 2

6th International Conference on Short & Medium Span Bridges. Vancouver. http://www.bridgeconference.com

SEPTEMBER

11-13

IABSE Symposium: Towards a Better Built Environment—Innovation, Sustainability, Information Technology. Melbourne, Australia. www.iabse.ethz.ch/conferences/melbourne

12-16

Annual Conference Association for Preservation Technology. Toronto. http://www.apti.org

15-18

Transportation Association of Canada 2002 Annual Conference and Exhibition. Winnipeg. www.tac-atc.ca

18-20

7th International Seminar on Structural Masonry *for Developing Countries. Belo Horizonte*, Brazil. http://www.cefetmg.br/masonry

22-25

American Public Works Association. APWA International Public Works Congress and Exposition. Kansas City, MI. http://www.apwa.net/Meetings/Congress/2002/Preview

23-25

ISARC 2002 International Symposium on Automation and Robotics in Construction. Washington, DC. http://www.bfrl.nist.gov/isarc2002

25-27

12th International Roofing and Waterproofing Conference—Exploring Tomorrow's Technology Today. Orlando, FL. Tel: (847) 299-9070 or (800) 323-9545 (within the US and Canada). http://www.nrca.net/technical/techconf/twelfth.asp

30

Workshop related to 6th Experts Meeting of *the International Energy Agency, IEA Task 27*, on Performance of Solar Façade Components. Ottawa. Contact: Hakim Elmahdy at (613) 993-9752; Fax: (613) 998-6802; E-mail: hakim.elmahdy@nrc.ca

OCTOBER

6-9

1st Annual Concrete Bridge Conference. Nashville, TN. http://www.NationalConcreteBridge.org/cbc/index.html

NOVEMBER

4-6

6th International Masonry Conference. British Masonry Society. London, UK. http://www.masonry.org.uk

6-8

DMinUCE—London 2002. The 3rd International Conference on Decision Making in Urban and Civil Engineering. http://www.serenade.org.uk

25-27

8e édition de la Semaine des infrastructures urbaines, INFRA 2002. Montreal. http://www.ceriu.qc.ca

Continued on page 8

This calendar does not include all events scheduled to take place during this time frame. For a more complete listing, see the Web version of "Upcoming events" at http://www.nrc.ca/irc/whatsnew/events.html

construction *innovation*

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